Strand 3: Patterns, Algebra, and Functions

Every student should unde rstand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

Concept 1: Patterns

Identify patterns and apply pattern recognition to reason mathematically.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
PO 1. Communicate orally a grade level appropriate pattern.	PO 1. Communicate a grade level appropriate pattern. (e.g., "♦,∇,♥ Repeat this complete pattern.")	PO 1. Communicate a grade level appropriate pattern, using symbols or numbers. (e.g., ∇, O, Δ, ∇, O, Δ, ∇, ___, ___, ___)	PO 1. Communicate a grade level appropria te iterative pattern, using symbols or numbers.	PO 1. Communicate a grade level appropriate iterative pattern, using symbols or numbers.	PO 1. Communicate a grade level appropriate iterative pattern, using symbols or numbers.	PO 1. Communicate a grade level appropriate recursive pattern, using symbols or numbers.	PO 1. Communicate a grade level appropriate recursive pattern, using symbols or numbers.	PO 1. Communicate a grade level appropriate iterative or recursive pattern, using symbols or numbers.	PO 1. Communicate a grade level appropriate iterative or recursive pattern, using symbols or numbers.
PO 2. Extend simple repetitive patterns using manipulatives.	PO 2. Extend a simple grade level appropriate repetitive pattern. (e.g., ↑, ↓, ↑, ↓, ↑, ___, ___, ___)	PO 2. Extend a grade level appropriate repetitive pattern. (e.g., 12, 22, 32, ___, ___, ___)	PO 2. Extend a grade level appropriate repetitive pattern. (e.g., 5, 10, 15, 20,...rule: add five or count by five's	PO 2. Extend a grade level appropriate iterative pattern.	PO 2. Extend a grade level appropriate iterative pattern.	PO 2. Extend a grade level appropriate iterative pattern.	PO 2. Extend a grade level appropriate recursive pattern.	PO 2. Extend a grade level appropriate iterative or recursive pattern.	PO 2. Find the n^{th} term of an iterative or recursive pattern.
PO 3. Create grade level appropriate patterns.	PO 3. Create grade level appropriate patterns.	PO 3. Create grade level appropriate patterns.	PO 3. Solve grade level appropriate pattern problems.	PO 3. Create grade level appropriate iterative patterns.	PO 3. Solve grade level appropriate iterative pattern problems.	PO 3. Solve grade level appropriate iterative pattern problems.	PO 3. Solve grade level appropriate recursive pattern problems.	PO 3. Solve grade level appropriate iterative or recursive pattern problems.	PO 3. Evaluate problems using basic recursion formulas.

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Concept 2: Functions and Relationships
Describe and model functions and their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
		PO 1. Describe the rule used in a simple grade level appropriate function. (e.g., T-chart, input/output model, and frames and arrows)	PO 1. Describe the rule used in a simple grade level appropriate function. (e.g., T-chart, input/output model and frames and arrows)	PO 1. Describe the rule used in a simple grade level appropriate function. (e.g., T-chart, input/output model)	PO 1. Describe the rule used in a simple grade level appropriate function. (e.g., T-chart, input/output model)	PO 1. Describe the rule used in a simple grade level appropriate function. (e.g., T-chart, input/output model)	PO 1. Describe the rule used in a simple grade level appropriate function. (e.g., T-chart, input/output model)	PO 1. Describe the rule used in a simple grade level appropriate function. (e.g., T-chart, input/output model)	PO 1. Determine if a relationship is a function, given a graph, table, or set of ordered pairs.
								PO 2. Distinguish between linear and nonlinear functions, given graphic examples.	PO 2. Describe a contextual situation that is depicted by a given graph.

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Concept 2: Functions and Relationships

Describe and model functions and their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
								PO 3. Determine whether a graph or table are related to a given an equation of the form $y=ax^2$ where 'a' is a natural number.	PO 3. Identify a graph that models a given real-world situation.
								PO 4. Identify independent and dependent variables for a contextual situation.	PO 4. Sketch a graph that models a given contextual situation.
									PO 5. Determine domain and range for a function.

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Concept 2: Functions and Relationships

Describe and model functions and their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 6. Determine the solution to a contextual maximum / minimum problem, given the graphical representation.
									PO 7. Express the relationship between two variables using tables/ matrices, equations, or graphs.
									PO 8. Interpret the relationship between data suggested by tables/ matrices, equations, or graphs.

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Concept 2: Functions and Relationships

Describe and model functions and their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 9. Determine from two linear equations whether the lines are parallel, perpendicular, coincident, or intersecting but not perpendicular.

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Concept 3: Algebraic Representations
Represent and analyze mathematical situations and structures using algebraic representations.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
				PO 1. Evaluate expressions involving the four basic operations by substituting given whole numbers for the variable.	PO 1. Evaluate expressions involving the four basic operations by substituting given decimals for the variable.	PO 1. Evaluate expressions involving the four basic operations by substituting given fractions for the variable. (e.g., n+3, when n= ½)	PO 1. Evaluate an expression containing two variables by substituting integers for the variable. (e.g., $7x + m$, when $x = -4$ and $m = 12$)	PO 1. Evaluate algebraic expressions by substituting rational values for variables. [e.g., $2(ab+ac+bc)$, when $a = 2$, $b = 3/5$, and $c = 4$]	PO 1. Evaluate algebraic expressions, including absolute value and square roots.
	PO 1. Use variables in contextual situations.	PO 1. Use variables in contextual situations.	PO 1. Use variables in contextual situations.	PO 2. Use variables in contextual situations.	PO 2. Use variables in contextual situations.	PO 2. Use variables in contextual situations.	PO 2. Use variables in contextual situations.	PO 2. Use variables in contextual situations.	PO 2. Simplify algebraic expressions.
									PO 3. Multiply and divide monomial expressions with integral exponents.

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Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
						PO 3. Translate a written phrase to an algebraic expression. (e.g., The quotient of m and 5 is $\frac{m}{5}$ *or* $m \div 5$.)	PO 3. Translate a written sentence into a one-step, one-variable algebraic equation.	PO 3. Translate a written sentence or phrase into an algebraic equation or expression and vice versa. (e.g., Three less than twice a number is $2n$-3.)	PO 4. Translate a written expression or sentence into a mathematical expression or sentence.
						PO 4. Translate a phrase written in context into an algebraic expression. (e.g., Write an expression to describe the situation: John has x pieces of candy and buys three more. $x + 3$)	PO 4. Translate a sentence written in context into an algebraic equation involving one operation.	PO 4. Translate a sentence written in context into an algebraic equation involving two operations.	PO 5. Translate a sentence written in context into an algebraic equation involving multiple operations.

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Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 6. Write a linear equation for a table of values.
								PO 5. Translate a contextual situation into an algebraic inequality. (e.g., Joe earns more than $5.00 an hour; therefore, $x > 5$)	PO 7. Write a linear algebraic sentence that represents a data set that models a contextual situation.
								PO 6. Identify an equation or inequality that represents a contextual situation.	

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Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
	PO 2. Find the missing sum or difference in number sentences for sums and minuends through 9 (e.g., 2 + 5 = _).	PO 2. Find the missing element (addend, subtrahend, minuend, sum, and difference) in addition and subtraction number sentences for sums through 18 and minuends through 9 (e.g., 13 - _ = 8).	PO 2. Solve equations with one variable using missing addends to sums of 18 (e.g., + 9 = 18, 9 + = 18); using minuend through 18. (e.g., 18 - = 9, 18 - 9 =)	PO 3. Solve one-step equations with one variable represented by a letter or symbol using multiplication of whole numbers. (e.g., 12 = n x 4)	PO 3. Solve one-step equations with one variable represented by a letter or symbol. (e.g., 15 = 45 ÷ n)	PO 5. Solve one-step equations with one variable represented by a letter or symbol, using inverse operations with whole numbers.	PO 5. Solve one-step equations using inverse operations with positive rational numbers. (e.g., $\frac{2}{3}n = 6$)	PO 7. Solve one-step equations with rational numbers as coefficients or as solutions.	PO 8. Solve linear (first degree) equations in one variable (may include absolute value).
								PO 8. Solve one-step equations that model contextual situations.	

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Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
								PO 9. Solve two-step equations with rational coefficients and integer solutions. (e.g., $3x + 5 = 11$, $4x – 20 = 8$)	
								PO 10. Graph an inequality on a number line.	PO 9. Solve linear inequalities in one variable.
									PO 10. Write an equation of the line given: two points on the line, the slope and a point on the line, or the graph of the line.
								PO 11. Solve a simple algebraic proportion.	PO 11. Solve an algebraic proportion.

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Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 12. Solve systems of linear equations in two variables (integral coefficients and rational solutions).
									PO 13. Add, subtract and perform scalar multiplication with matrices.
									PO 14. Calculate powers and roots of real numbers, both rational and irrational, using technology when appropriate.

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Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
								PO 12. Solve applied problems using the Pythagorean theorem.	PO 15. Simplify square roots and cube roots with monomial radicands (including those with variables) that are perfect squares or perfect cubes.
									PO 16. Solve square root radical equations involving only one radical.

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Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 17. Solve quadratic equations.
									PO 18. Identify the sine, cosine, and tangent ratios of the acute angles of a right triangle.

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Concept 4: Analysis of Change
Analyze change in a variable over time and in various contexts.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
	PO 1. Identify the change in a variable over time. (e.g., an object gets taller, colder, heavier, etc.)	PO 1. Identify the change in a variable over time. (e.g., an object gets taller, colder, heavier, etc.)	PO 1. Identify the change in a variable over time. (e.g., an object gets taller, colder, heavier, etc.)	PO 1. Identify the change in a variable over time. (e.g., an object gets taller, colder, heavier, etc.)	PO 1. Describe patterns of change. • constant rate (speed of movement of the hands on a clock) • increasing or decreasing rate (rate of plant growth)	PO 1. Identify values on a given line graph or scatter plot. (e.g., Given a line showing wages earned per hour, what is the wage at five hours?)	PO 1. Analyze change in various linear contextual situations.	PO 1. Identify the slope of a line as the rate of change. (the ratio of rise over run)	PO 1. Determine slope, x-, and y-intercepts of a linear equation.
	PO 2. Make simple predictions based on a variable (e.g., select next stage of plant growth).	PO 2. Make simple predictions based on a variable (e.g., a child's height from year to year).	PO 2. Make simple predictions based on a variable (e.g., increases in allowance as you get older).	PO 2. Make simple predictions based on a variable (e.g., increase homework time as you progress through the grades).					PO 2. Solve formulas for specified variables.